

***Aedes (Stegomyia) josiahae*, A NEW SPECIES OF THE
simpsoni SUBGROUP (DIPTERA: CULICIDAE)¹**

YIAU-MIN HUANG

Systematics of *Aedes* Mosquitoes Project, Department of Entomology, Smithsonian Institution, Washington, D.C. 20560.

Abstract.—The adult male and female of *Aedes (Stegomyia) josiahae* n. sp. from Tanzania are described and illustrated. Diagnostic characters for distinguishing *Ae. josiahae* from closely allied species are given. The distribution of *Ae. josiahae* is based on examined specimens. *Aedes josiahae* is most closely related to *Ae. kivuensis* Edwards. These two species together with *Ae. bromeliae* (Theobald), *Ae. lilii* (Theobald), *Ae. simpsoni* (Theobald), *Ae. strelitziae* Muspratt, *Ae. subargenteus* Edwards, and *Ae. woodi* Edwards form the *simpsoni* subgroup within the *aegypti* group.

Key Words: Culicidae, mosquitoes, *Aedes*, *simpsoni* subgroup

A new species of *Aedes (Stegomyia)*, belonging to the *simpsoni* subgroup of the *aegypti* group, was discovered among specimens that were misidentified as *Aedes (Stegomyia) kivuensis* Edwards from the Division of Vector Borne Diseases (DVBD) collection in Nairobi, Kenya. In view of the medical importance of several species in the *simpsoni* subgroup and the similarity of this new species with *Ae. kivuensis* Edwards, it is desirable to describe the new species here to make its name available and to avoid future confusion between it and *Ae. kivuensis*. As nothing is known about its biting habits and potential as a vector of human pathogens, it is hoped that this paper will stimulate investigations on these subjects.

MATERIALS AND METHODS

This study is based on specimens that were borrowed from the following institutions: Musee royale de l'Afrique Centrale, Tervuren, Belgium [CMT] and Division of Vector Borne Diseases, Ministry of Health, Nairobi, Kenya [DVBD]. Distributional records are listed in the following order and format: current country names are in capital letters, administrative divisions, where known, are in italics, and place names have the first letter capitalized.

The terminology follows that of Harbach and Knight (1980, 1981), with the exception of "tarsal claws," which is retained for "ungues." The venation terms follow those of Belkin (1962).

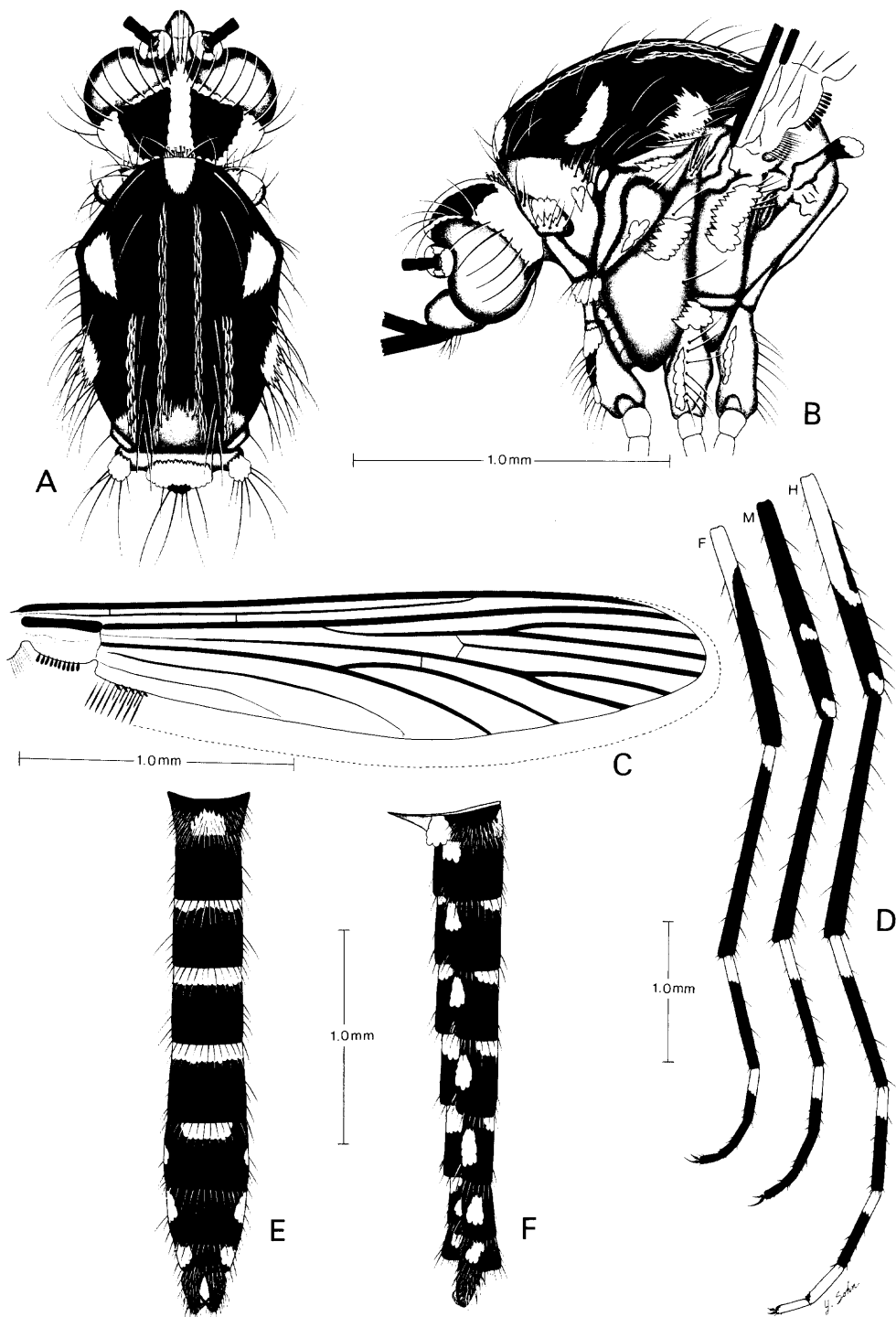
***Aedes (Stegomyia) josiahae* Huang,
NEW SPECIES**

Figs. 1-4

Female.—**Head:** Proboscis bearing dark scales, lacking pale scales on ventral surface, length as long as forefemur; maxillary palpus 0.27 length of proboscis, dark, bearing

¹ This work was supported by Grant No. DAMD-17-84-G-4033 from the U.S. Army Medical Research and Development Command, Office of the Surgeon General, Fort Detrick, Frederick, MD 21701, and by the Walter Reed Biosystematic Unit, Museum Support Center, Smithsonian Institution, Washington, D.C. 20560.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE APR 1988		2. REPORT TYPE		3. DATES COVERED 00-00-1988 to 00-00-1988	
4. TITLE AND SUBTITLE Aedes (Stegomyia) Josiahae, A New Species of the Simpsoni Subgroup (Diptera: Culicidae)				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Smithsonian Institution, Medical Entomology Project, Washington, DC, 20560				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT see report					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 10	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Aedes (Stegomyia) josiahae n. sp. ♂

white scales on apical 0.50 of the total length; pedicel covered with white scales except on dorsal and ventral surfaces; clypeus bare; occiput with few erect forked scales; a row of broad white scales around eye margins; vertex with a median stripe of broad white scales, with broad dark scales on each side interrupted by a lateral stripe of broad white scales, followed ventrally by a patch of broad white scales. *Thorax*: Scutum with narrow dark scales and a distinct, median white spot of narrow scales on anterior promontory, followed by a submedian longitudinal stripe of narrow yellowish scales on each side of midline, reaching to prescutellar area and connecting with prescutellar line of narrow yellowish scales; fossal area with a large patch of broader, crescent-shaped white scales; posterior dorsocentral yellowish lines present, reaching posterior 0.50 of scutum; a patch of narrow white scales on lateral margin just in front of wing root; acrostichal setae absent; dorsocentral setae present; scutellum with broad white scales on all lobes and with a few broad dark scales at apex of midlobe; anteprenotum with broad white scales; postpronotum with a patch of broad white scales and a few narrow dark scales dorsally; paratergite with broad white scales; postspiracular area without scales; hypostigmal area without scales; patches of broad white scales on propleuron, subspiracular area, upper and lower portions of mesokatepisternum, and on mesepimeron; upper mesokatepisternal scale patch not reaching to anterior corner of mesokatepisternum; upper mesepimeral scale patch connected to lower mesepimeral scale patch; lower mesepimeron without setae; metameron bare. *Wing*: With dark scales on all veins and without a minute basal spot of white scales on costa; cell R_2 2.8 length of

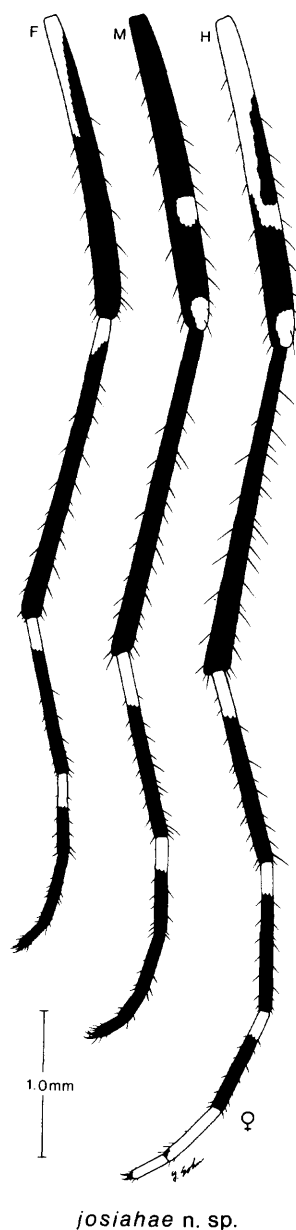
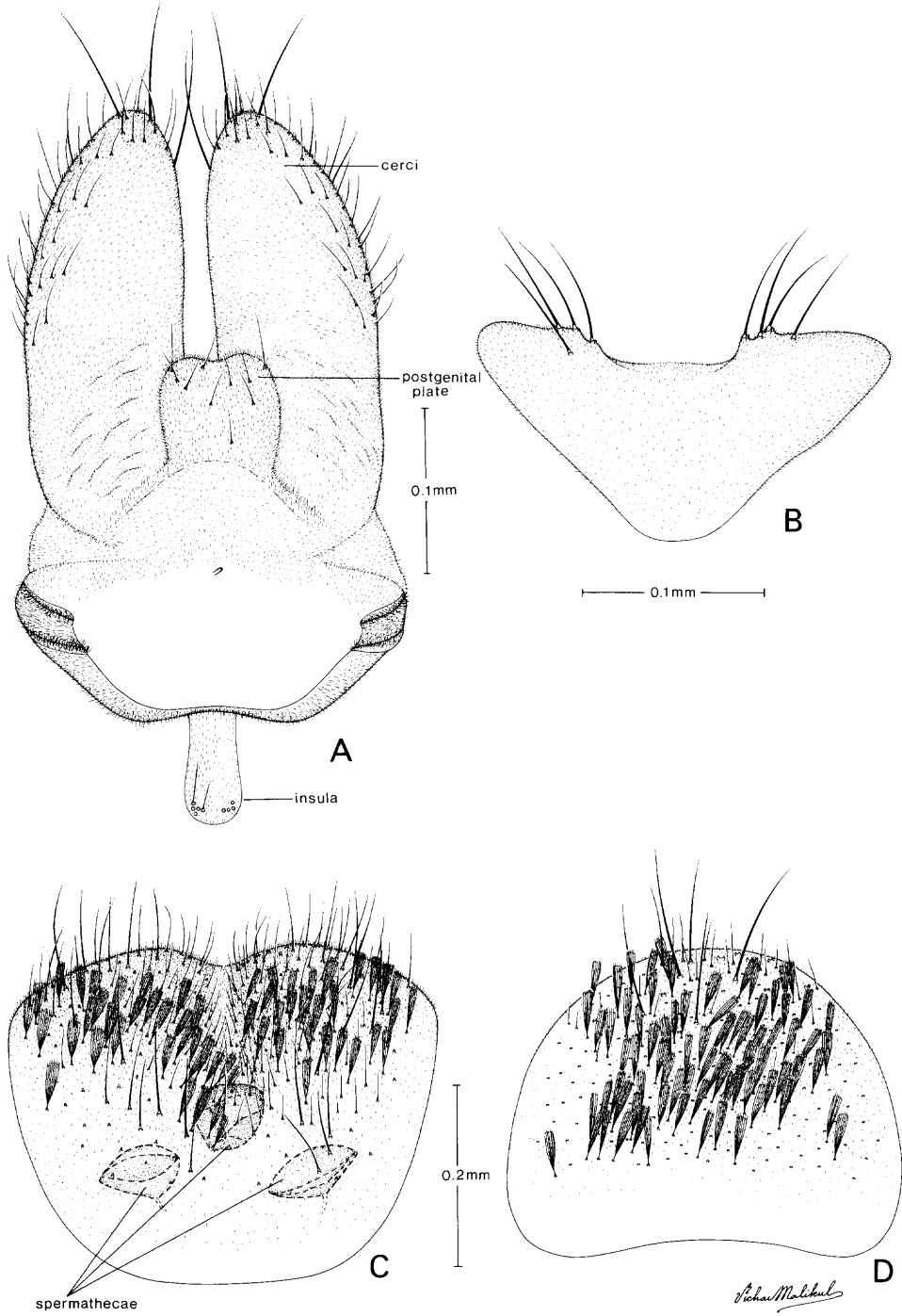


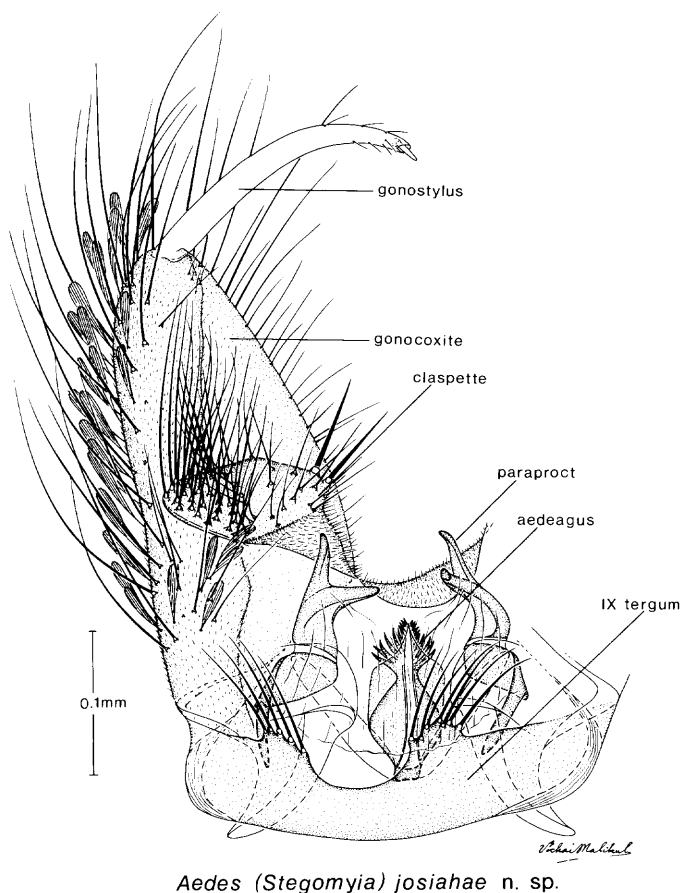
Fig. 2. *Aedes (Stegomyia) josiahae* n. sp. Anterior surface of the allotype female legs.

Fig. 1. *Aedes (Stegomyia) josiahae* n. sp., holotype male. A, Dorsal aspect of the thorax; B, Lateral aspect of the thorax; C, Dorsal aspect of the wing; D, Anterior surface of the legs; E, Dorsal aspect of the abdomen; F, Lateral aspect of the abdomen.



Aedes (Stegomyia) josiahae n. sp.

Fig. 3. *Aedes (Stegomyia) josiahae* n. sp. A, Sternal aspect of the female genitalia; B, Dorsal aspect of IX-tergum; C, Dorsal aspect of VIII-sternum; D, Dorsal aspect of VIII-tergum.

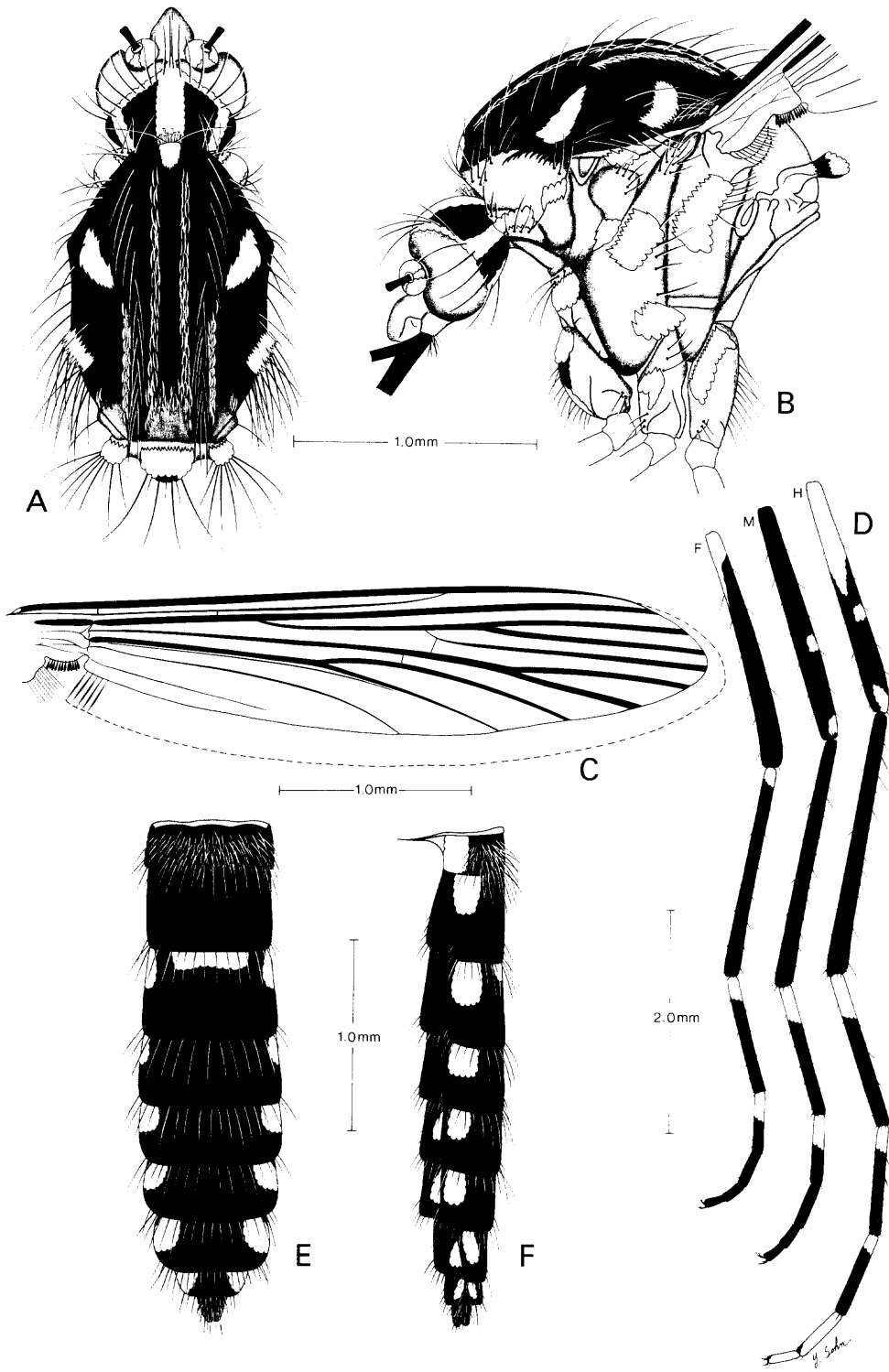


Aedes (Stegomyia) josiahae n. sp.

Fig. 4. *Aedes (Stegomyia) josiahae* n. sp. Tergal aspect of the male genitalia.

R_{2+3} . *Halter*: With dark and pale scales. *Legs* (Fig. 2): Coxae with patches of white scales; white knee-spot absent on forefemur, present on mid- and hindfemora; forefemur anteriorly with a narrow, white longitudinal stripe on ventral surface in basal 0.40; midfemur with a large white spot on anterior surface about 0.67 from base; hindfemur anteriorly with a broad white longitudinal stripe in basal 0.66 that widens 0.25 from base; foretibia anteriorly dark, with a basal white band; mid- and hindtibiae all dark; fore- and midtarsi with a basal white band on tarsomeres 1, 2; foretarsomere 1 with basal 0.20 white on dorsal surface; foretarsomere 2 with basal 0.40–0.50 white on dor-

sal surface; midtarsomere 1 with basal 0.30–0.33 white on dorsal surface; midtarsomere 2 with basal 0.40 white on dorsal surface; hindtarsus with a basal white band on tarsomeres 1–3, the ratio of length of white band on dorsal surface to the total length of tarsomere is 0.25, 0.20–0.25, and 0.25; hindtarsomere 4 all white, with a few dark scales at apex on ventral surface; hindtarsomere 5 all white, with a few dark scales at apex on ventral surface; fore- and midlegs with tarsal claws equal, all toothed; hindleg with tarsal claws equal, both simple. *Abdomen*: Tergum I with white scales on laterotergite and with a median white spot; terga II–VI each with a basal white band



Aedes (Stegomyia) kivuensis Edwards ♀

and basolateral white spots not connecting with basal white band; terga VII, VIII each with basolateral white spots only; sterna III–VII each with a basal white band; segment VIII largely retracted. *Genitalia* (Fig. 3): Apical margin of sternum VIII with a median notch and with rounded lateral lobes; insula longer than wide, with minute setae and with 9 larger setae on apical 0.25; tergum IX broader than long, apical margin of tergum IX with well developed lateral lobes, each with 4 setae; apical margin of postgenital plate with a shallow median notch; cercus short and broad; 3 spermathecae, one larger than the other 2.

Male (Fig. 1).—Essentially as in the female, differing in the following sexual characters: *Head*: Maxillary palpus 5-segmented, as long as proboscis, predominantly dark, with a white band at base of palpomeres 2–5; those on palpomeres 4, 5 dorsally incomplete; palpomeres 4, 5 subequal, slender, dorsally curved and with only a few short setae; antenna plumose, shorter than proboscis. *Wing* (Fig. 1C). Cell R_2 3.1 length of R_{2+3} . *Legs* (Fig. 1D): Midfemur with a large white spot on anterior surface 0.65–0.67 from base; hindfemur anteriorly with a broad white longitudinal stripe in basal 0.60–0.61 that widens 0.22 from base; foretarsomere I with basal 0.20–0.25 white on dorsal surface; foretarsomere 2 with basal 0.50 white on dorsal surface; midtarsomere 1 with basal 0.33 white on dorsal surface; midtarsomere 2 with basal 0.50 white on dorsal surface; hindtarsus with a basal white band on tarsomeres 1–3, the ratio of length of white band on dorsal surface to the total length of tarsomere is 0.25–0.30, 0.25–0.33, and 0.33; fore- and midlegs with tarsal claws unequal, all simple. *Abdomen* (Fig. 1E, F): Tergum II with basolateral white spots only; sternum VIII with basolateral white spots

only. *Genitalia* (Fig. 4): Gonocoxite 2.2–2.4 as long as wide (width measured 0.5 from base), scales restricted to dorsolateral, lateral and ventral surfaces, with setae on dorsomesal surface, mesal surface membranous; claspette large, broad, reaching to 0.54 of gonocoxite, distal expanded portion square in shape in dorsal aspect, with numerous simple setae on the expanded distal portion and bearing 2(1–2) stronger, basally widened spine-like setae on the apicomesal angle; gonostylus simple, elongate, about 0.66 length of gonocoxite, with a short claw process at apex and with a few setae on apical 0.25; aedeagus strongly toothed; paraproct with a sternal arm; cercal setae absent; apical margin of tergum IX deeply concave medially, with 5–7 setae on each lateral lobe; sternum IX without setae.

Pupa and larva.—Unknown.

Type data.—Holotype male (MEP Acc. 808/#157/Tanganyika, 60–70 km. south of Ifakara, Dr. H. Briegel) with genitalia on slide (81/21), Ifakara, TANZANIA (Tanganyika), no date (H. Briegel). Deposited in Division of Vector Borne Diseases, Ministry of Health, Nairobi, Kenya. Allotype female (MEP Acc. 808/#157), same data as holotype [DVBD]. Paratypes: 1 male (MEP Acc. 808/#160) with genitalia on slide (81/22) and 1 female (MEP Acc. 808/#154) with genitalia on slide (81/23), same data as holotype [DVBD].

Other material examined.—TANZANIA (Tanganyika). *Morogoro Region*: Ifakara (8°08'S, 36°41'E), Mselezi (8°46'S, 36°42'E), H. Briegel, 1 F (#146) [DVBD].

Distribution.—This species is presently known only from Tanzania (Tanganyika).

Etymology.—This species is named to honor Mrs. Phoebe A. O. Josiah, Senior Entomologist, Division of Vector Borne Diseases, Ministry of Health, Nairobi, Ke-

←

Fig. 5. *Aedes (Stegomyia) kivuensis* Edwards, holotype female. A, Dorsal aspect of the thorax; B, Lateral aspect of the thorax; C, Dorsal aspect of the wing; D, Anterior surface of the legs; E, Dorsal aspect of the abdomen; F, Lateral aspect of the abdomen.

nya, in recognition and appreciation of her contributions to our knowledge of the mosquito fauna of Africa.

Taxonomic discussion.—*Aedes* (*Stegomyia*) *joshiahae* is a member of the *simpsoni* subgroup of the *aegypti* group. The *simpsoni* subgroup presently comprises at least eight species (*Ae. simpsoni* (Theobald) 1905, *Ae. lilii* (Theobald) 1910, *Ae. bromeliae* (Theobald) 1911, *Ae. woodi* Edwards 1922, *Ae. subargenteus* Edwards 1925, *Ae. kivuensis* Edwards 1941, *Ae. strelitziae* Muspratt 1950 and *Ae. joshiahae* n. sp.) and is characterized by the following combination of characters: the scutum has a pair of submedian stripes, a white knee-spot is absent on the forefemur but present on the mid- and hindfemora; midfemur has a large, white spot on the anterior surface and the hindtarsus has a basal white band on tarsomeres 1–3. *Aedes joshiahae* differs from all other members of the *simpsoni* subgroup except *Ae. kivuensis*, however, by the following combination of characters: (1) scutum with anterior median white spot of narrow scales; (2) scutellum with broad white scales on all lobes; (3) hindtibia anteriorly dark, without a white stripe in basal area; (4) hindtarsomeres 4 and 5 entirely white.

Aedes joshiahae is most closely related and similar to *Ae. kivuensis*, and I consider *joshiahae* to be a sister species of *kivuensis*. Adults of *Ae. joshiahae* are extremely similar to those of *Ae. kivuensis* with which it has been confused and misidentified. *Aedes joshiahae* can be distinguished easily from *Ae. kivuensis*, however, by the hindfemur, which anteriorly has a broad white stripe in basal 0.60–0.66 and by the presence of a median white spot on tergum I. In *Ae. kivuensis*, the hindfemur anteriorly has a broad white stripe on the basal half, and has a white spot about 0.62 from the base (the white spot does not connect with the basal white stripe) and the tergum I has white scales only on the laterotergite (see Fig. 5).

The male genitalia of *Ae. joshiahae* are easily differentiated from all other species

in the *simpsoni* subgroup by the claspette, which has the distal expanded portion square in the dorsal aspect, with numerous simple setae on the expanded distal portion and bearing 2(1–2) stronger, basally widened spine-like setae on the apicomesal angle.

Gerberg and Van Someren (1970: 2) reported that *Ae. (Stg.) kivuensis* was collected in Tanzania by Dr. H. Briegel of the Swiss Tropical Institute at Ifakara. However, the specimens from Tanzania (Dr. H. Briegel) in the DVBD collection are not *Ae. kivuensis*, but are the new species *joshiahae*.

Aedes joshiahae is apparently an East African lowland species. Based on the present collection data, *Ae. joshiahae* occurs in habitats with altitudes of 500 m (1500 ft) and yearly rainfall of 88.90 cm (35 in.). *Aedes kivuensis* is presently known only from Zaire (Belgian Congo), where it occurs in habitats with altitudes of 2166 m (6500 ft) and yearly rainfall of 152.40 cm (60 in.).

Medical importance.—Unknown. However, the *simpsoni* subgroup is one of the most important subgroups of *Stegomyia* from the standpoint of transmission of pathogens. *Aedes bromeliae* is an important vector of yellow fever virus in East Africa. *Aedes simpsoni* was incriminated in the transmission of yellow fever virus during an outbreak of yellow fever in Bwamba County, Uganda, in 1941 and yellow fever virus has been isolated from wild caught mosquitoes (*Ae. simpsoni*) from Bwamba, Uganda, (Mahaffy et al. 1942). The yellow fever virus has also been isolated from wild caught mosquitoes (*Ae. simpsoni*) in Uganda by Smithburn and Haddow (1946). However, the species from which Mahaffy et al. (1942) and Smithburn and Haddow (1946) isolated yellow fever virus was *Ae. bromeliae*, not *Ae. simpsoni* (see Huang 1986). *Aedes simpsoni* (probably *Ae. bromeliae*) from Nigeria has been shown to be a laboratory transmitter of yellow fever (Philip, 1929). *Aedes strelitziae* from South Africa can transmit yellow fever virus from one rhesus monkey to another under labo-

ratory conditions, as shown by Gillett and Ross (1953).

ACKNOWLEDGMENTS

I express my sincere appreciation to Wayne N. Mathis, Department of Entomology, Smithsonian Institution, and Ronald A. Ward and E. L. Peyton, Walter Reed Biosystematics Unit, for critically reviewing this manuscript and for their valuable comments. I am most grateful to J. Decelle and E. De Coninck, Department of Zoologie, Section d'Entomologie, Musee Royale de l'Afrique Centrale, Tervuren, Belgium, for the loan of the holotype of *kivuensis* Edwards used in this study; to J. M. D. Roberts, Davy K. Koech (formerly of DVBD) and Mrs. Phoebe A. O. Josiah, Division of Vector Borne Diseases (DVBD), Ministry of Health, Nairobi, Kenya, for the loan of the specimens described above, and for their cooperation and kind assistance during the course of the museum and field studies on African *Stegomyia* mosquitoes in Kenya. I also express my gratitude to Young T. Sohn and Vichai Malikul, formerly of the Medical Entomology Project, for preparing the illustrations.

LITERATURE CITED

- Belkin, J. N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae). Univ. Calif. Press, Berkeley and Los Angeles. 2 vols., 608 and 412 pp.
- Edwards, F. W. 1922. Mosquito notes.—III. Bull. Entomol. Res. 13: 75–102.
- . 1925. Mosquito notes.—V. Bull. Entomol. Res. 15: 257–270.
- . 1941. Mosquitoes of the Ethiopian region. III. Culicine adults and pupae. Br. Mus. (Nat. Hist.), Lond. 499 pp.
- Gerberg, E. J. and E. C. C. Van Someren. 1970. Pictorial key to the mosquitoes *Aedes* (*Stegomyia*) of East Africa. WHO/VBC/70.236: 1–7.
- Gillett, J. D. and R. W. Ross. 1953. The laboratory transmission of yellow fever by the mosquito *Aedes* (*Stegomyia*) *strelitziae* Muspratt. Ann. Trop. Med. Parasit. 47: 367–370.
- Harbach, R. E. and K. L. Knight. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, N.J. 415 pp.
- . 1981(1982). Corrections and additions to taxonomists' glossary of mosquito anatomy. Mosq. Syst. 13: 201–217.
- Huang, Y.-M. 1986. *Aedes* (*Stegomyia*) *bromeliae* (Diptera: Culicidae), the yellow fever virus vector in East Africa. J. Med. Entomol. 23: 196–200.
- Mahaffy, A. F., K. C. Smithburn, H. R. Jacobs, and J. D. Gillett. 1942. Yellow fever in western Uganda. Trans. R. Soc. Trop. Med. Hyg. 36: 9–20.
- Muspratt, J. 1950. Notes on *Aedes* (Diptera, Culicidae) from Natal, with a description of a new species of the subgenus *Stegomyia*. J. Entomol. Soc. Afr. 13: 73–79.
- Philip, C. B. 1929. Preliminary report of further tests with yellow fever transmission by mosquitoes other than *Aedes aegypti*. Am. J. Trop. Med. 9: 267–269.
- Smithburn, K. C. and A. J. Haddow. 1946. Isolation of yellow fever virus from African mosquitoes. Am. J. Trop. Med. 26: 261–271.
- Theobald, F. V. 1905. A new *Stegomyia* from the Transvaal. Entomol. 38: 224–225.
- . 1910. A monograph of the Culicidae or mosquitoes. Vol. V. Br. Mus. (Nat. Hist.), Lond. 646 pp., 6 pl.
- . 1911. Uganda Culicidae including thirteen new species. Novae Culicidae. Part I, 35 pp.

